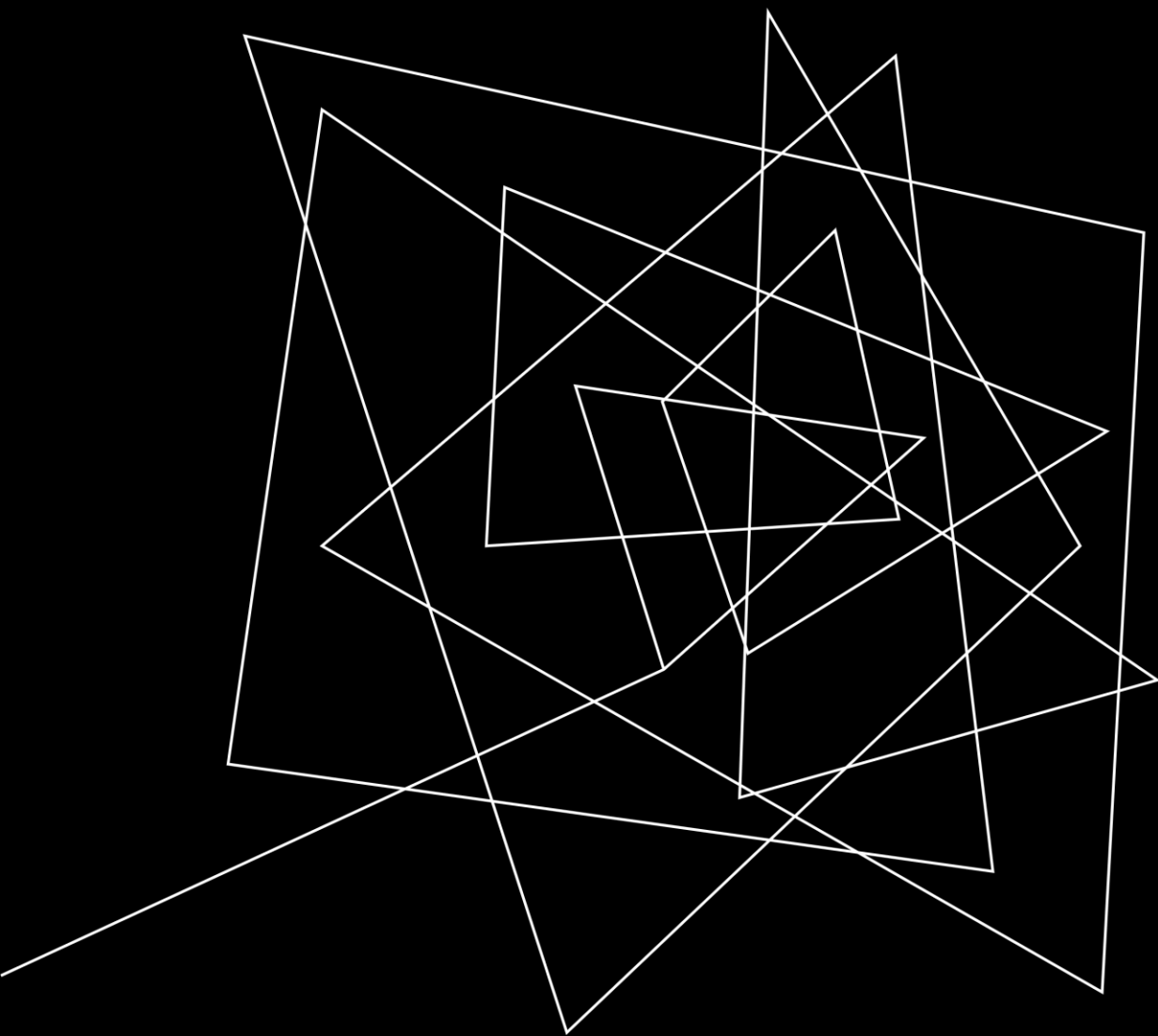
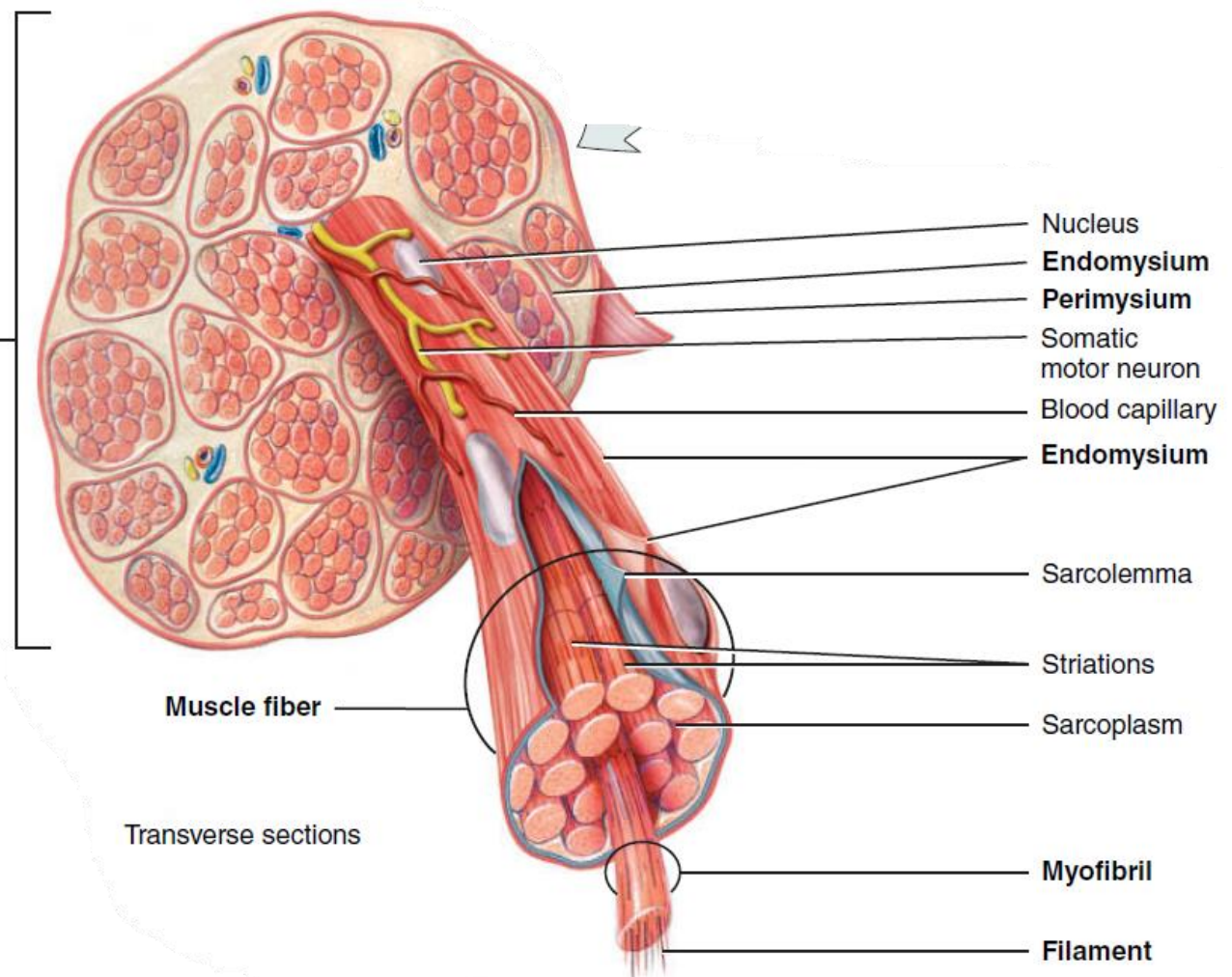
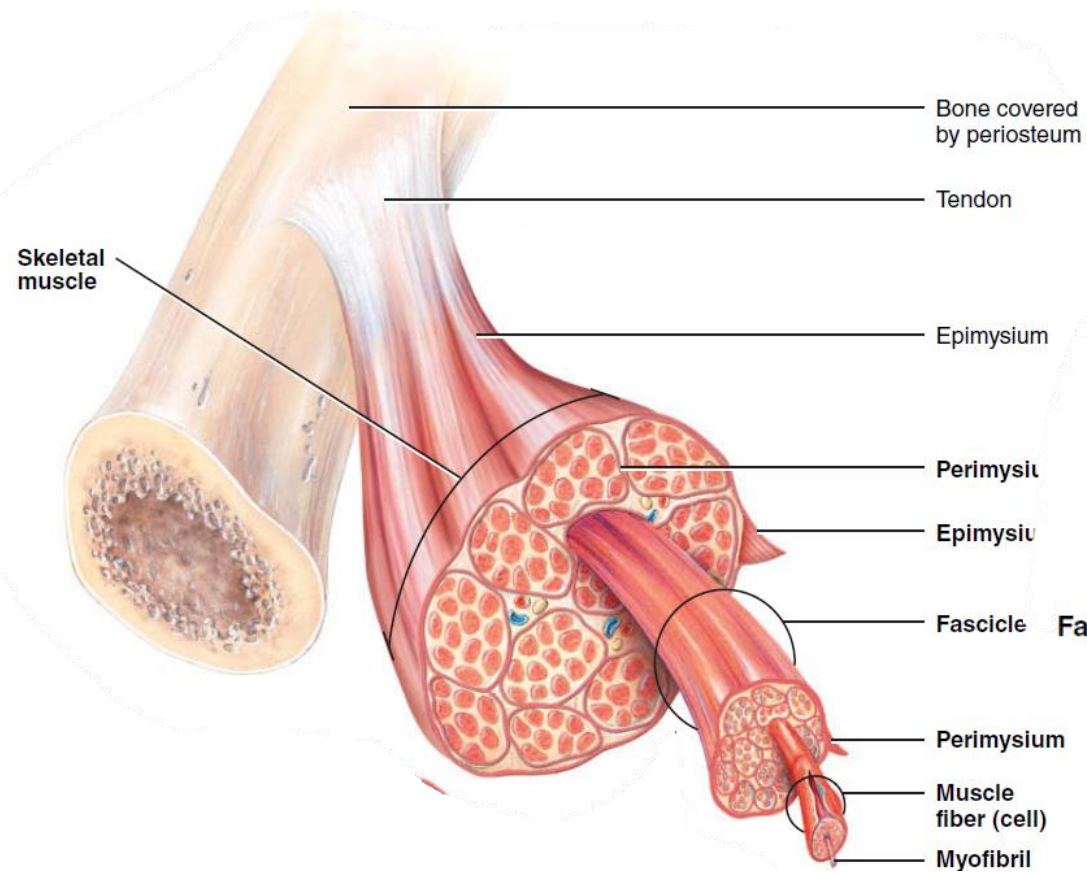
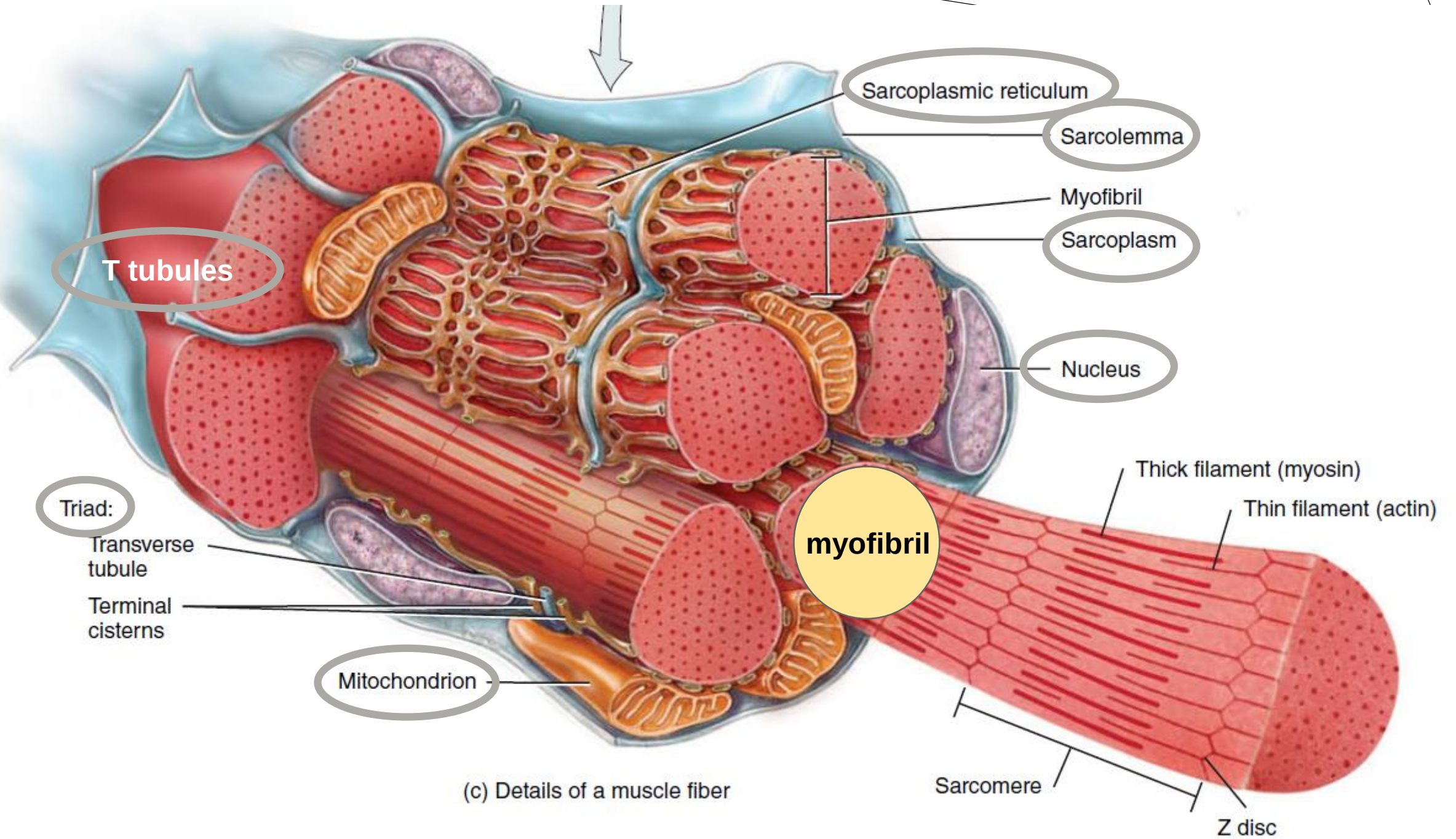




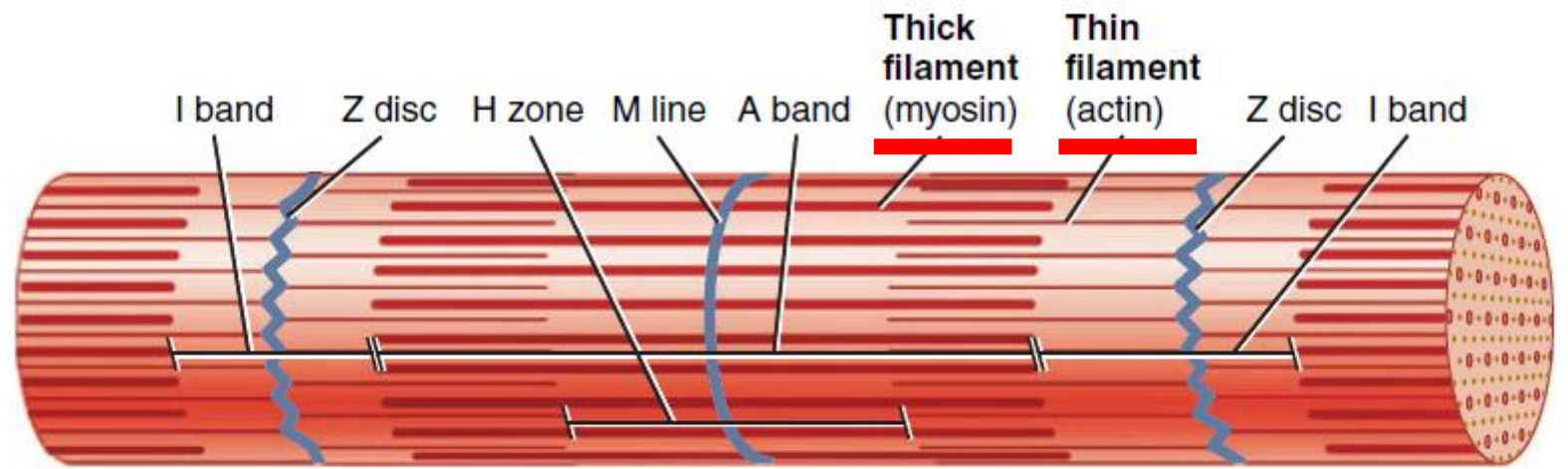
SKELETAL MUSCLE

structure



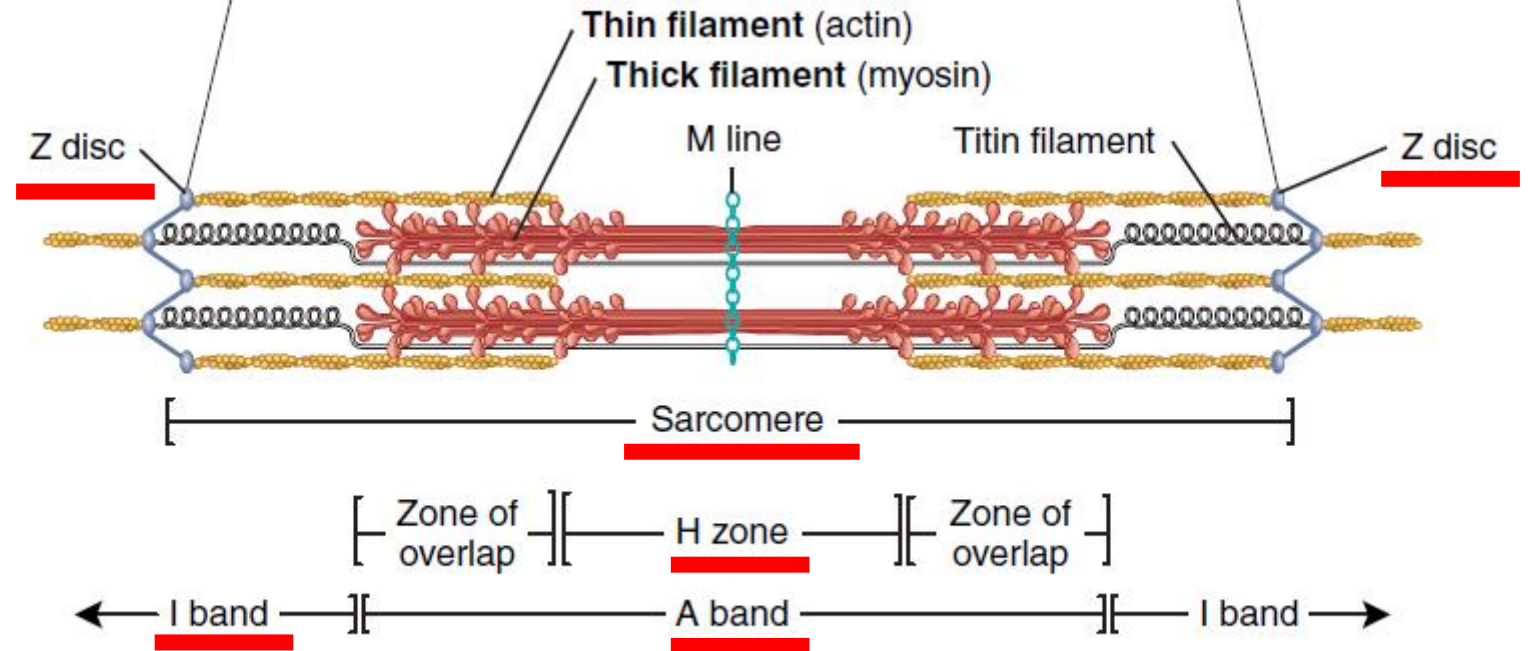
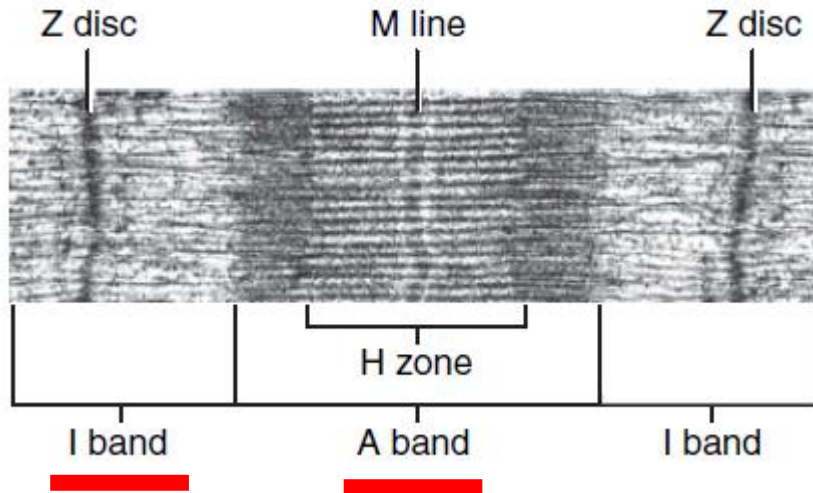


(c) Details of a muscle fiber



Sarcomere

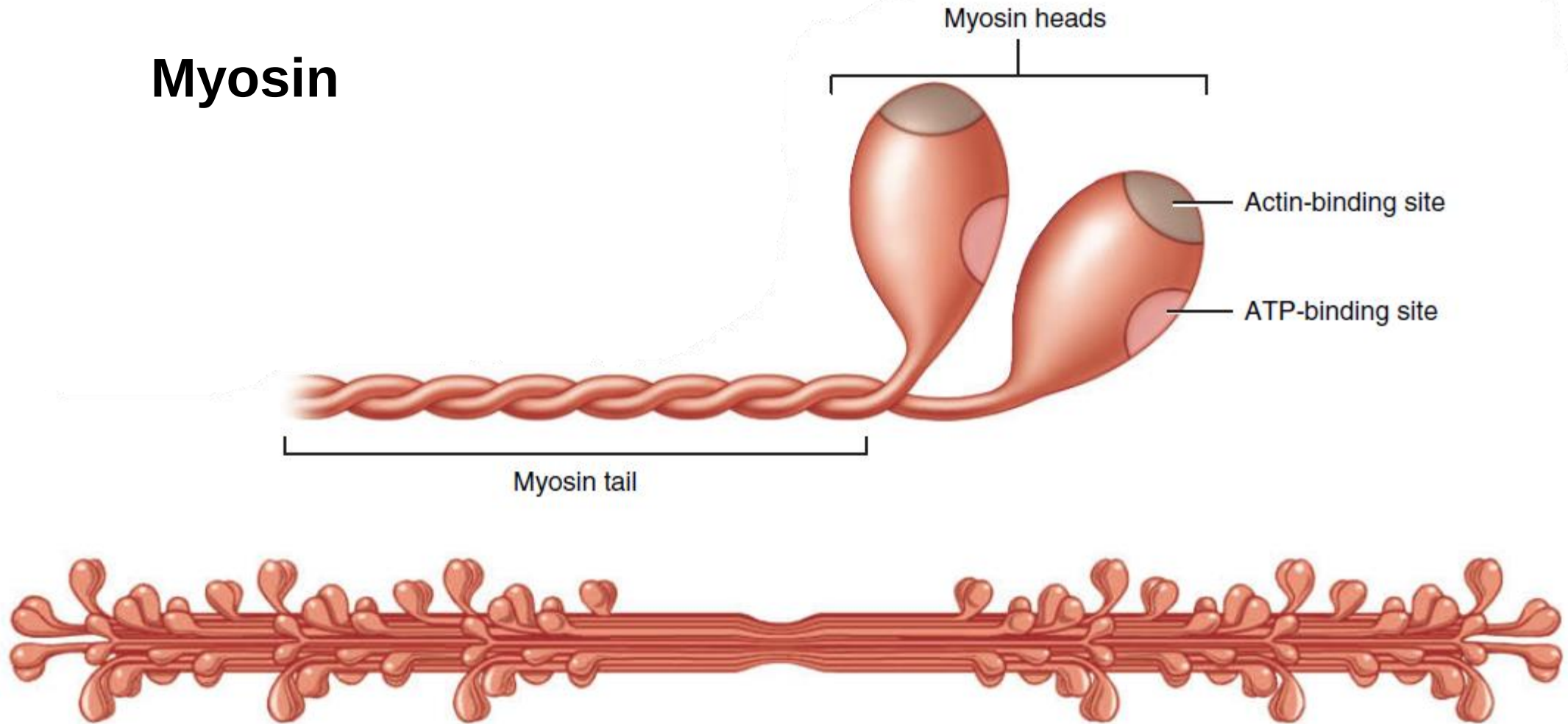
(a) Myofibril



(b) Details of filaments and Z discs

Contractile Proteins

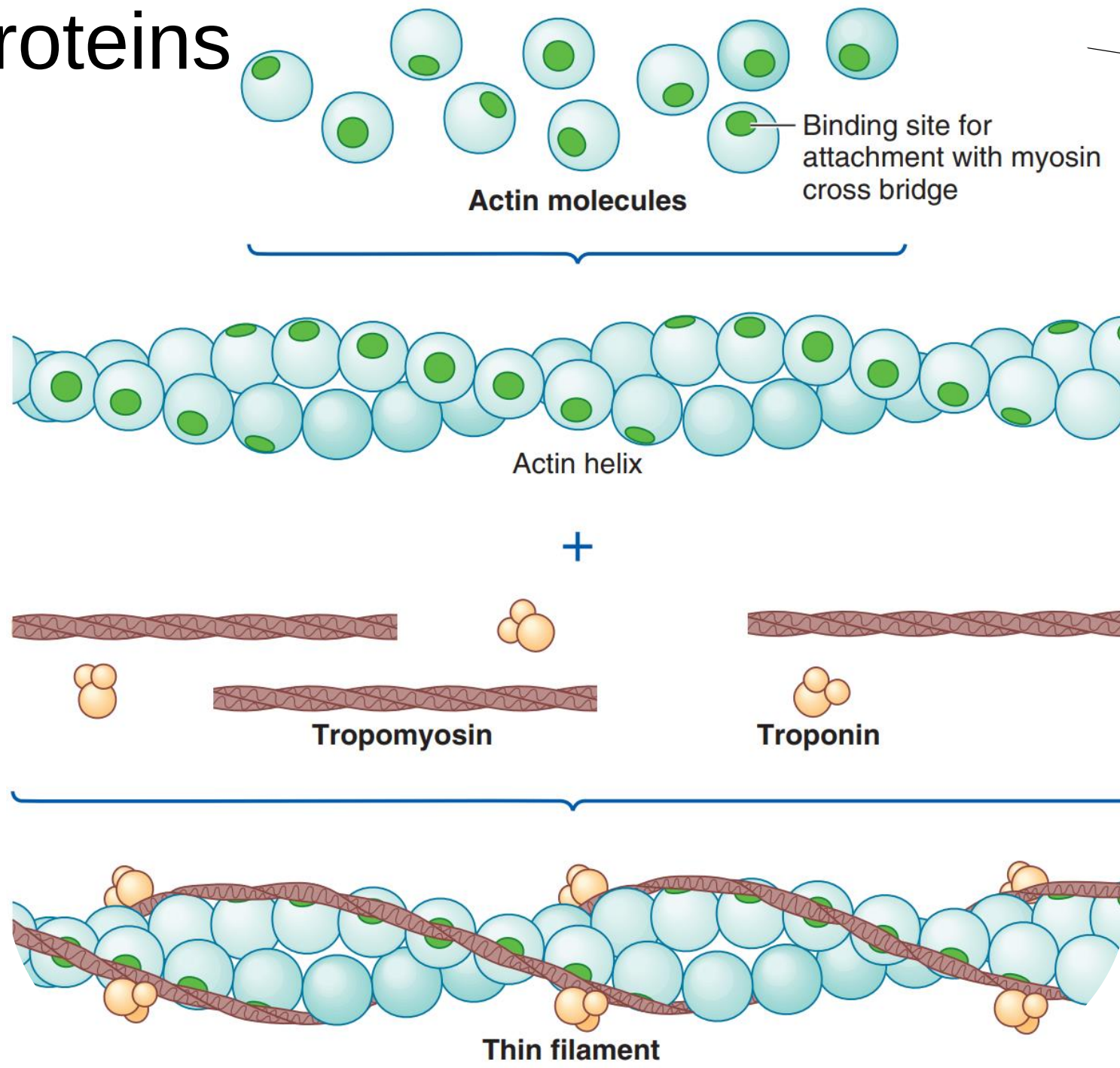
Myosin

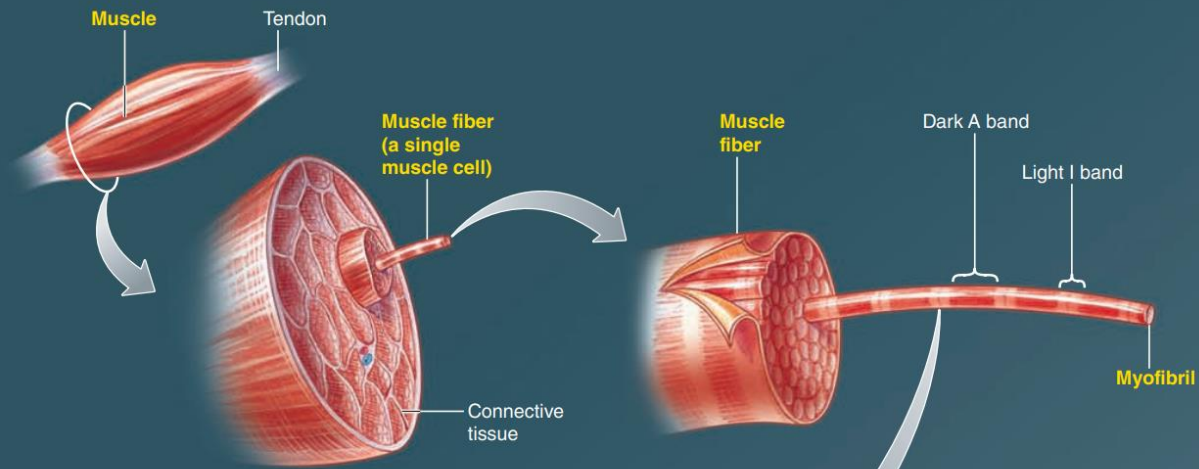


(a) Thick filament (below) and myosin molecule (above)

Contractile Proteins

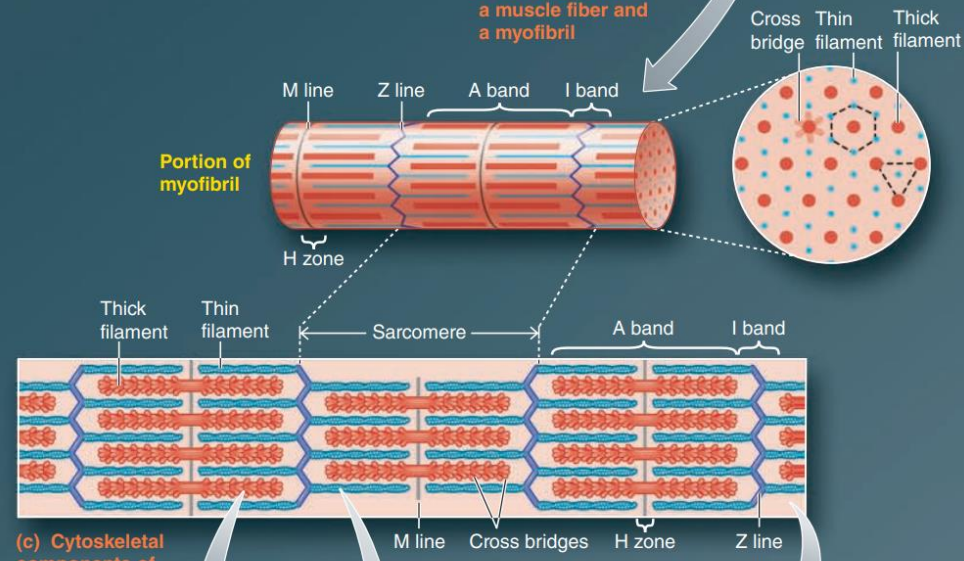
Actin



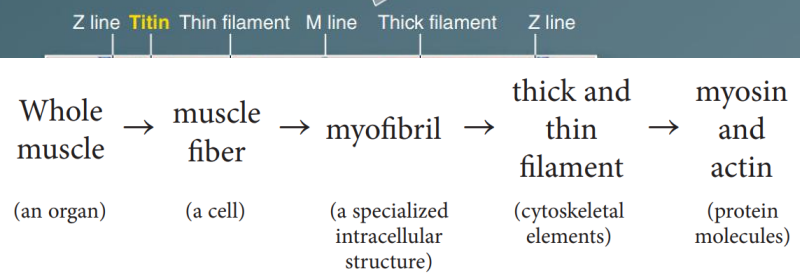
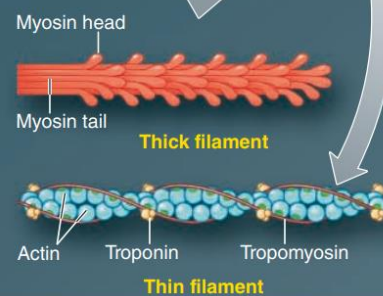


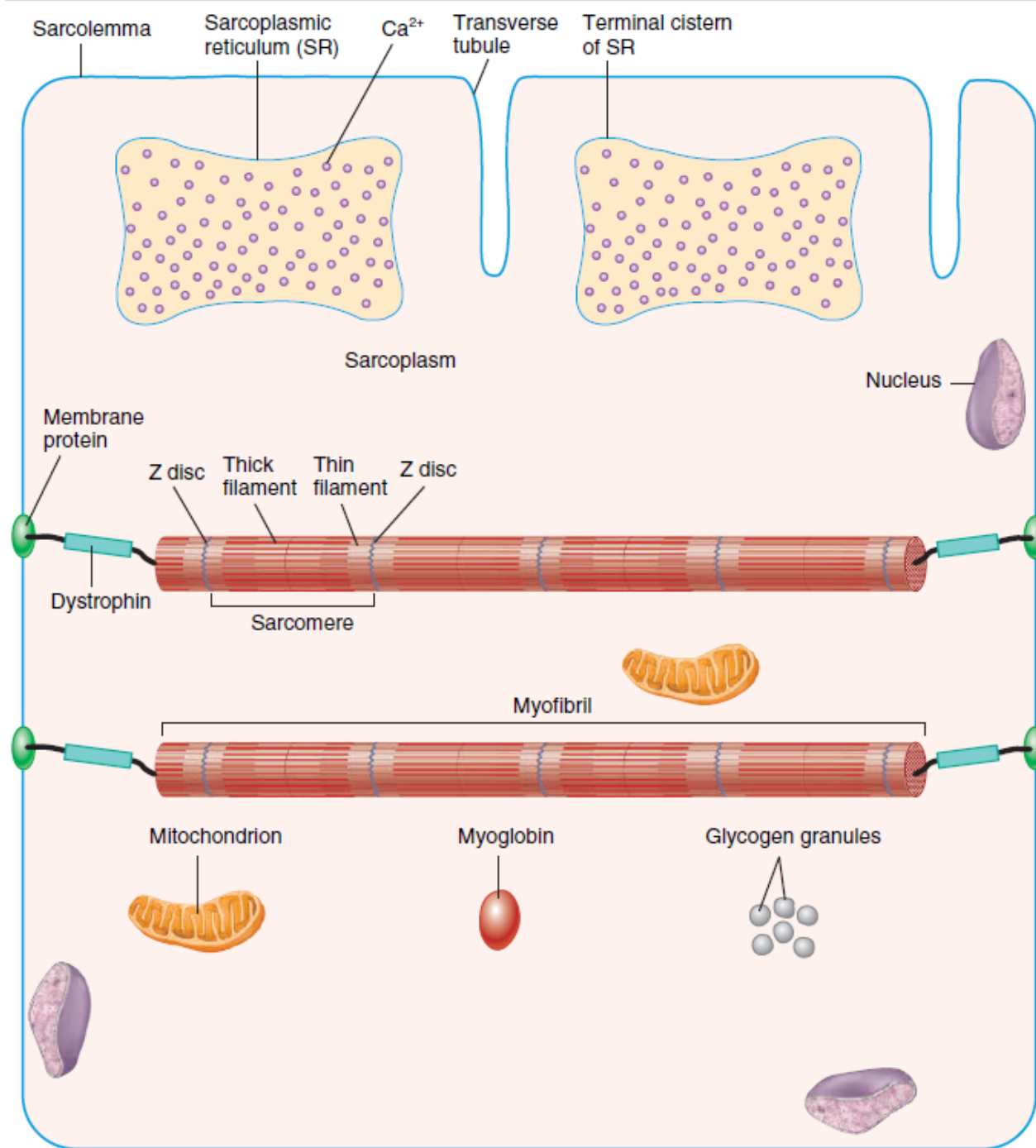
(a) Relationship of a whole muscle and a muscle fiber

(b) Relationship of a muscle fiber and a myofibril

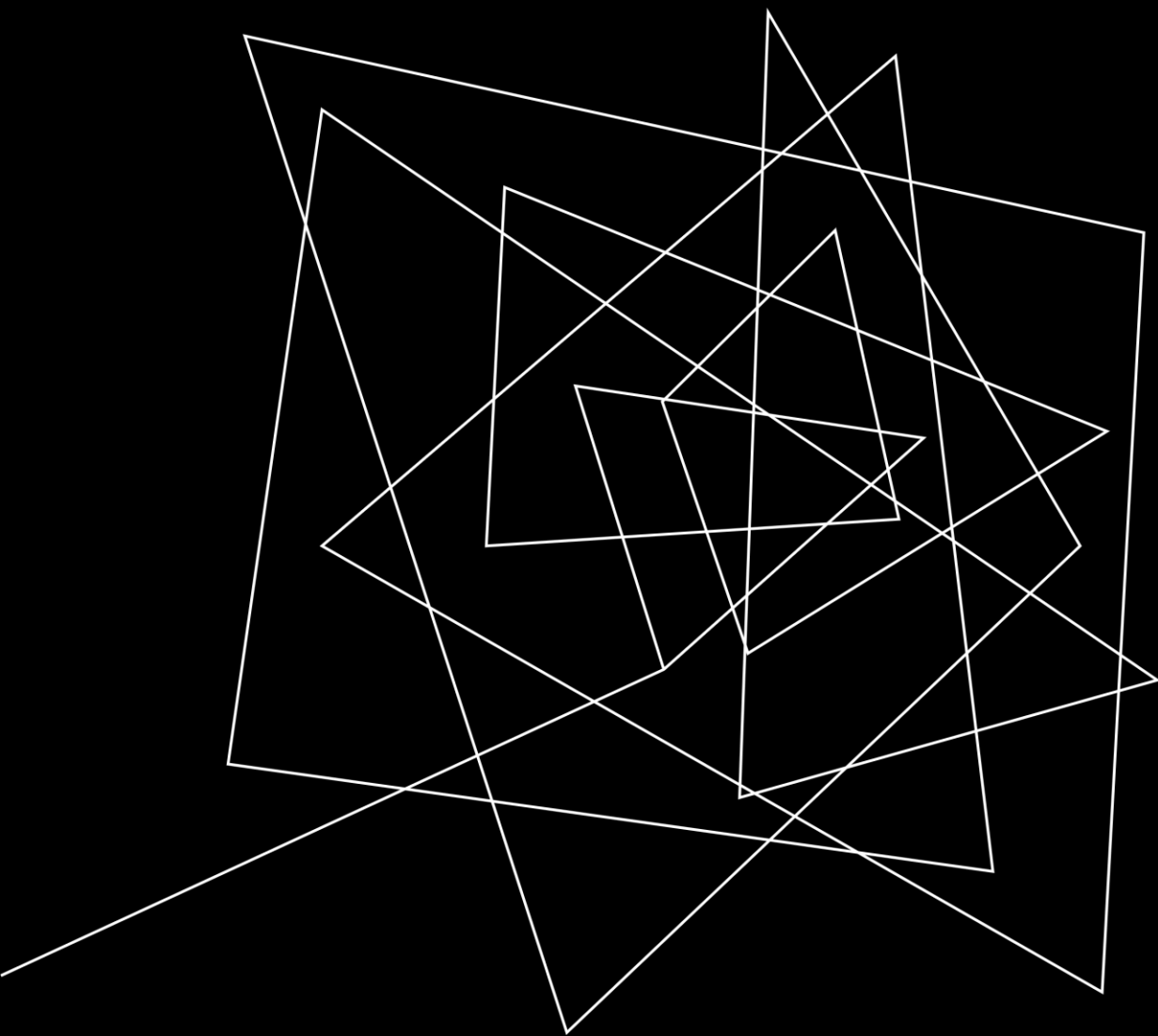


(c) Cytoskeletal components of a myofibril





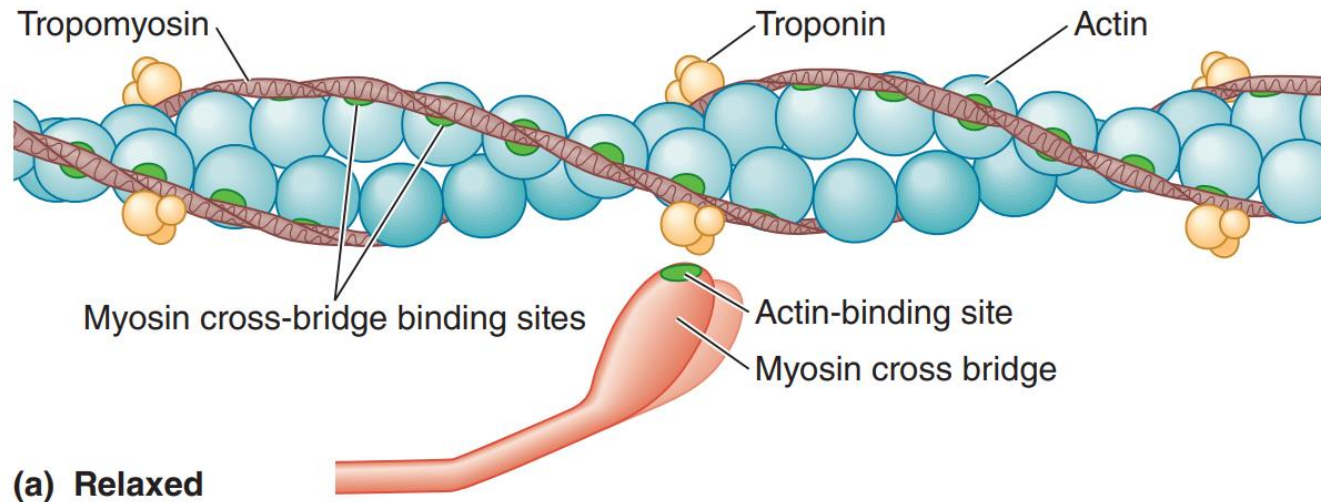
(d) Simplistic representation of the components of a muscle fiber



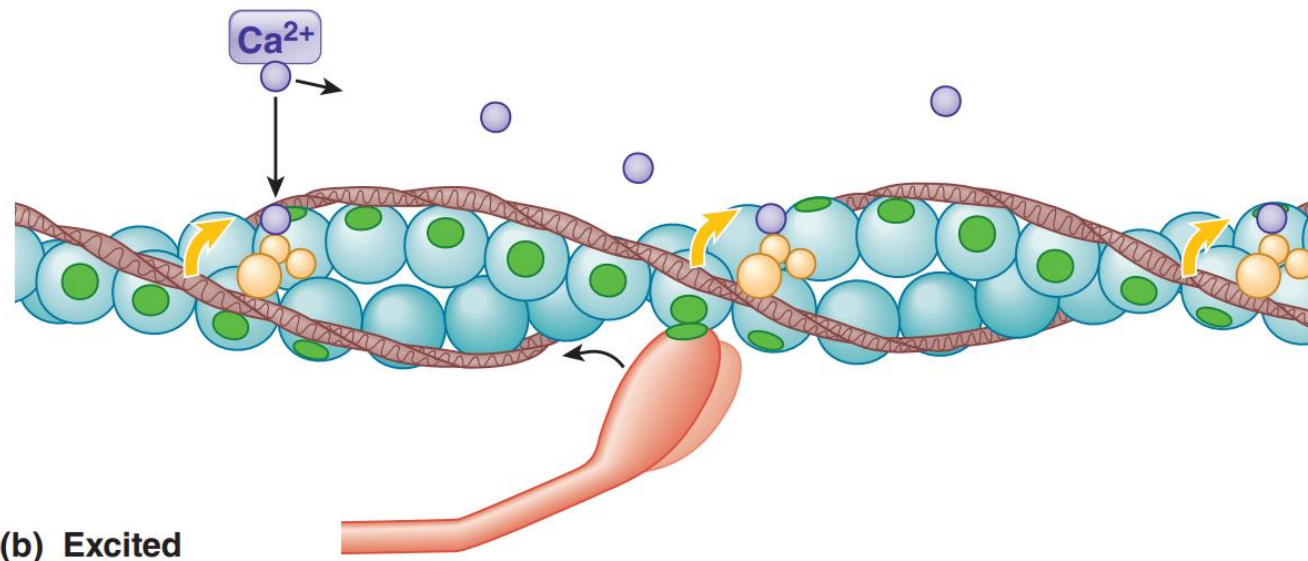
SKELETAL MUSCLE

Molecular Basis of
Skeletal Muscle
Contraction
sliding filaments

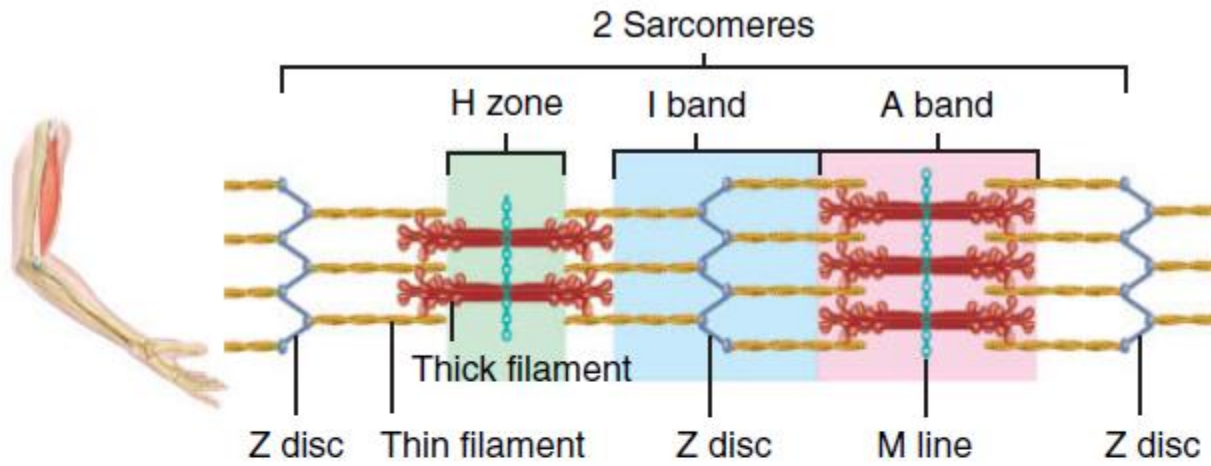
Cross-bridging



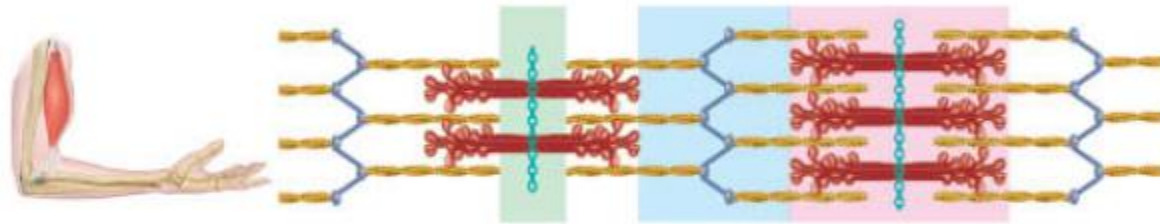
- 1 No excitation.
- 2 No cross-bridge binding because cross-bridge binding site on actin is physically covered by troponin–tropomyosin complex.
- 3 Muscle fiber is relaxed.



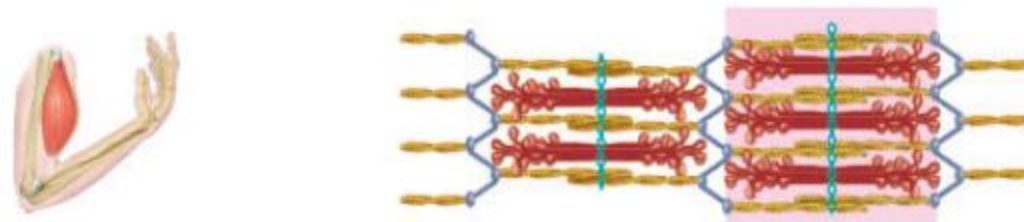
The Sliding Filament Mechanism



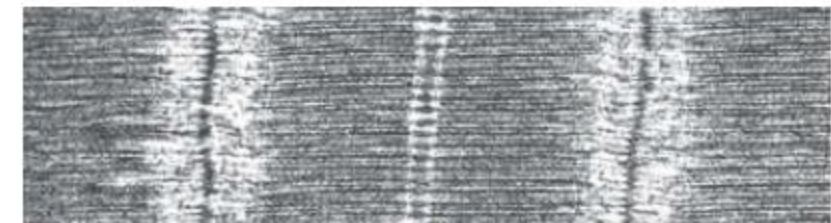
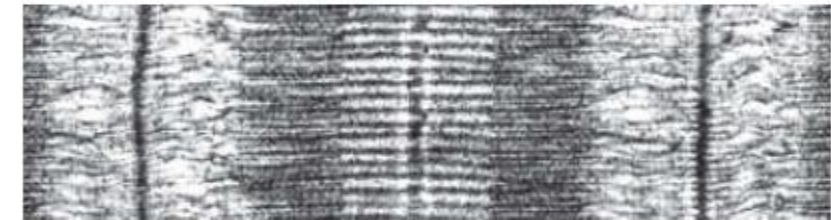
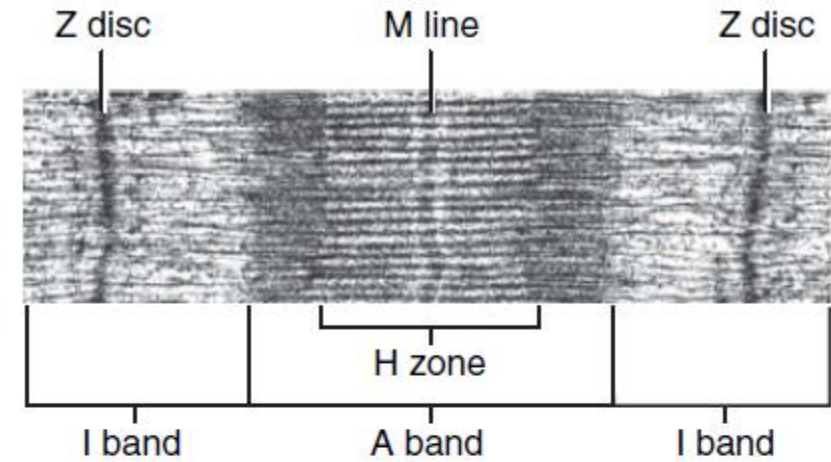
(a) Relaxed muscle



(b) Partially contracted muscle



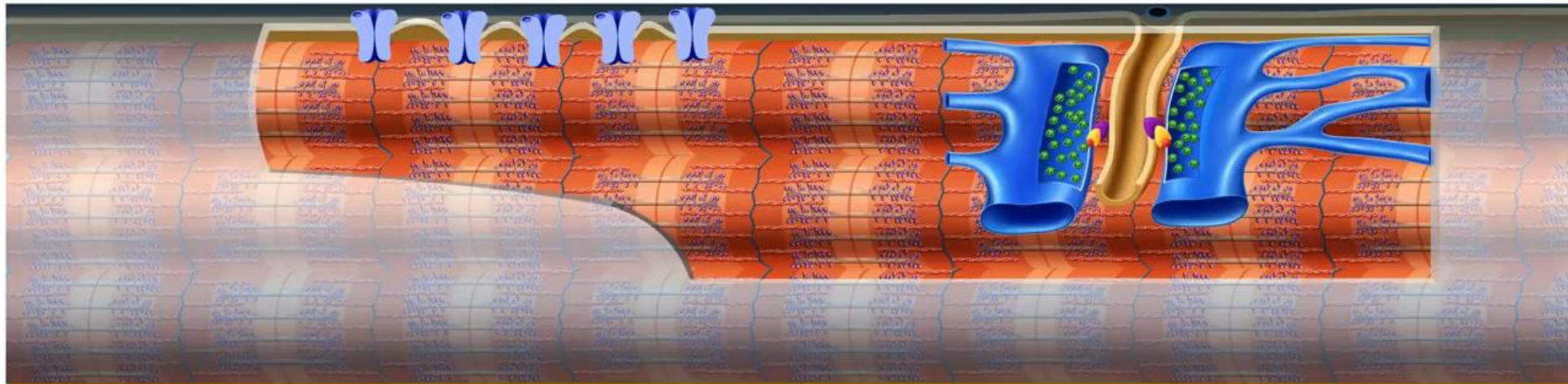
(c) Maximally contracted muscle

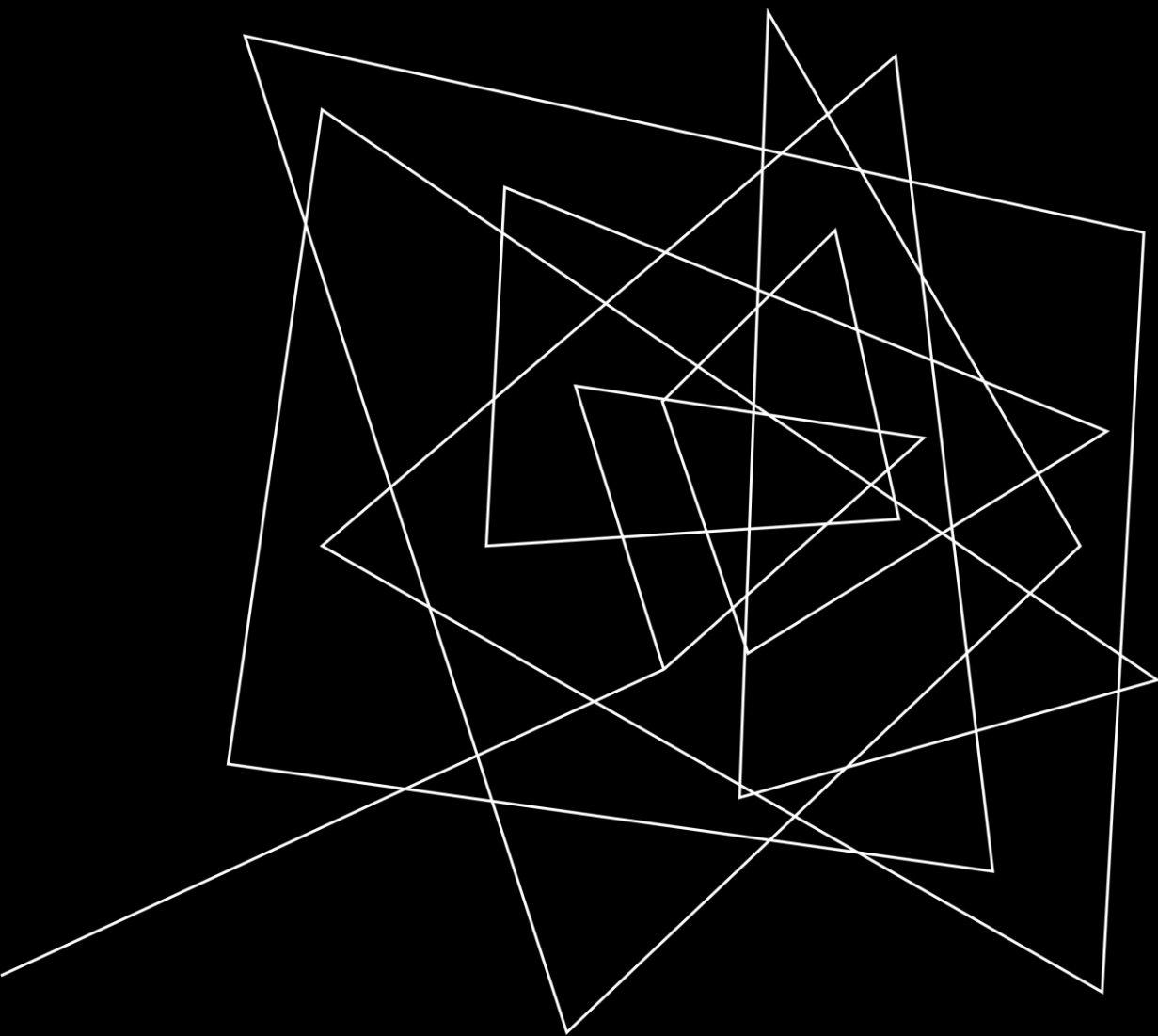


Courtesy Hiroyouki Sasaki, Yale E.Goldman and Clara Franzini-Armstrong

Skeletal Muscle Contraction

Excitation Contraction Coupling

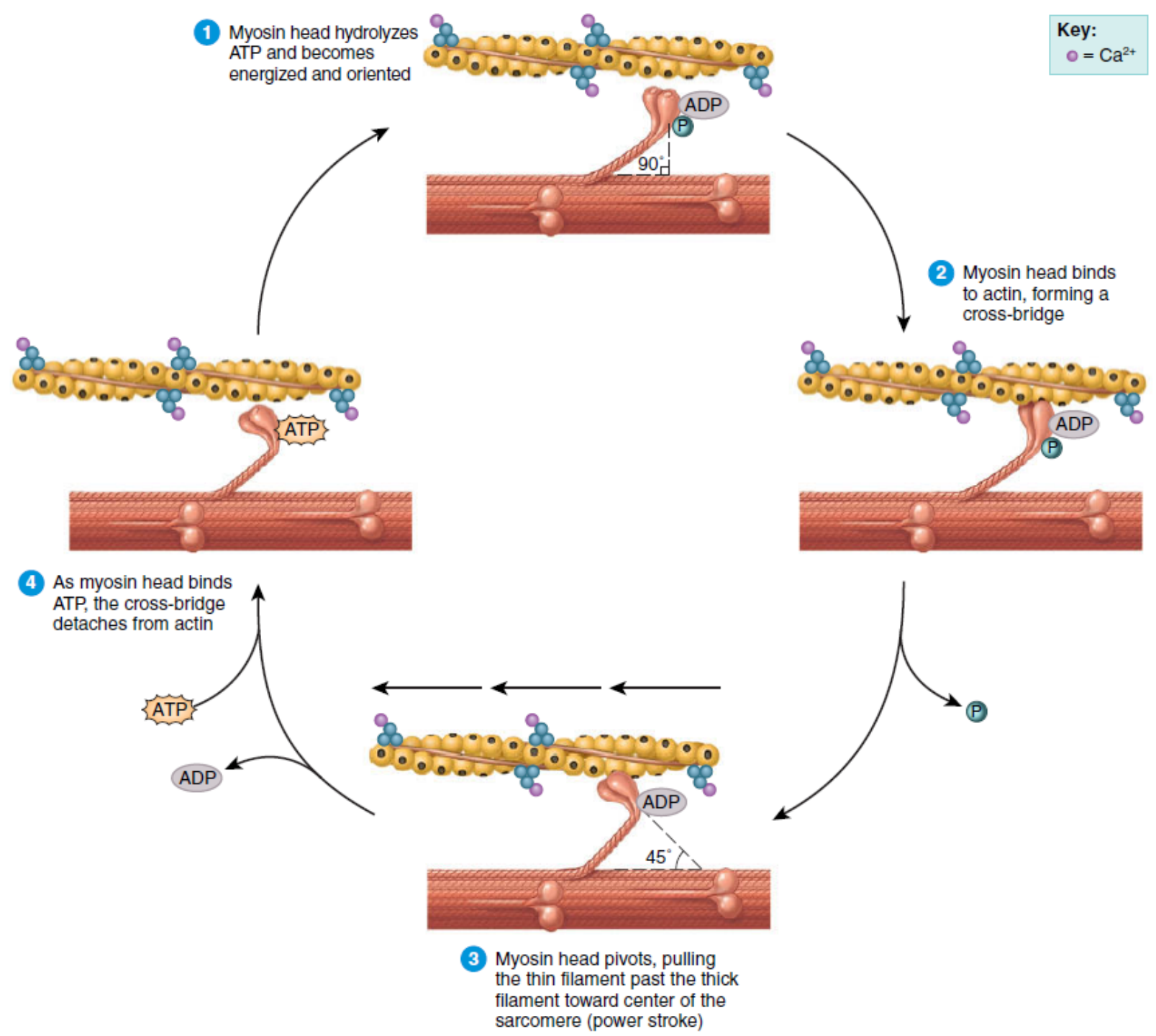




SKELETAL MUSCLE

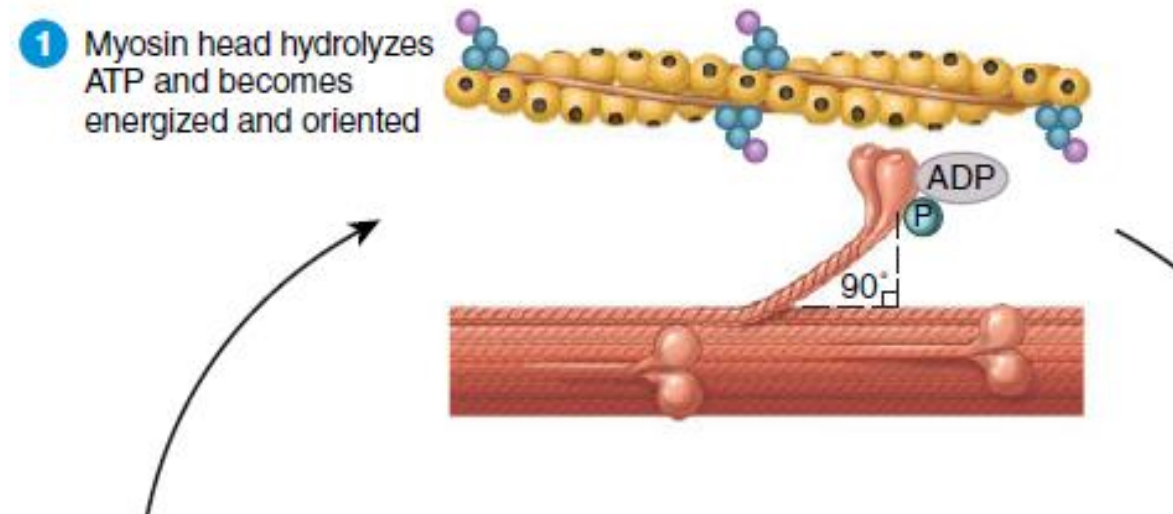
Contraction _ contraction
cycle

THE CONTRACTION CYCLE



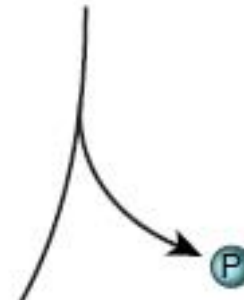
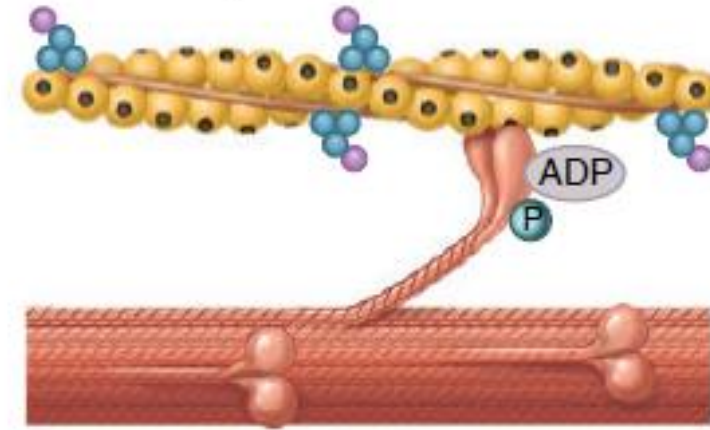
STEP 1: ATP HYDROLYSIS.

- The energy generated from ATP hydrolysis reaction is stored in the myosin head.
- The energized myosin head is perpendicular (at a 90° angle) relative to the thick and thin filaments and has the proper orientation to bind to an actin molecule.
- Notice that ADP and a phosphate group are still attached to the myosin head.



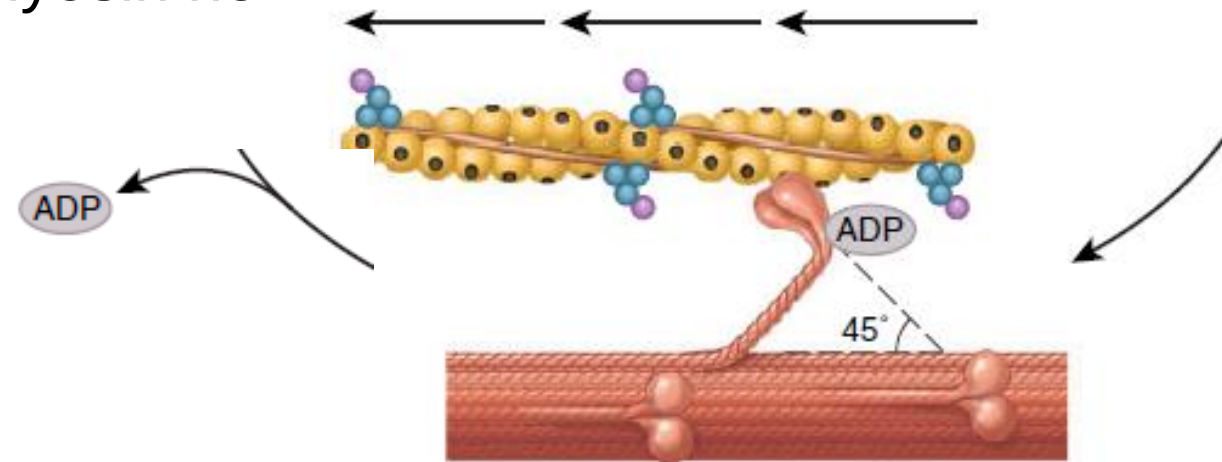
STEP 2: ATTACHMENT OF MYOSIN TO ACTIN

- The energized myosin head attaches to the myosin-binding site on actin and releases the phosphate group.
- When a myosin head attaches to actin during the contraction cycle, the myosin head is referred to as a **cross-bridge**.



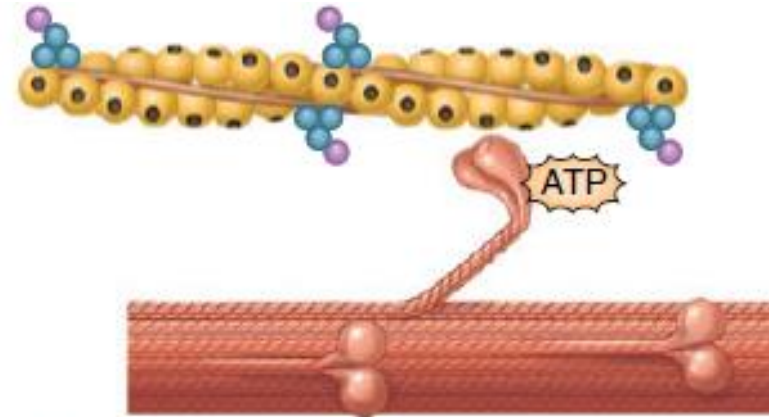
STEP 3: POWER STROKE

- After a cross-bridge forms, the myosin head pivots, changing its position from a 90° angle to a 45° angle.
- As the myosin head changes to its new position, it pulls the thin filament past the thick filament toward the center of the sarcomere, generating tension (force).
- This event is known as the **power stroke**.
- Once the power stroke occurs, ADP is released from the myosin head.



STEP 4: DETACHMENT OF MYOSIN FROM ACTIN

- At the end of the power stroke, the cross-bridge remains firmly attached to actin until it binds another molecule of ATP.
- As ATP binds to the ATP binding site on the myosin head, the myosin head detaches from actin

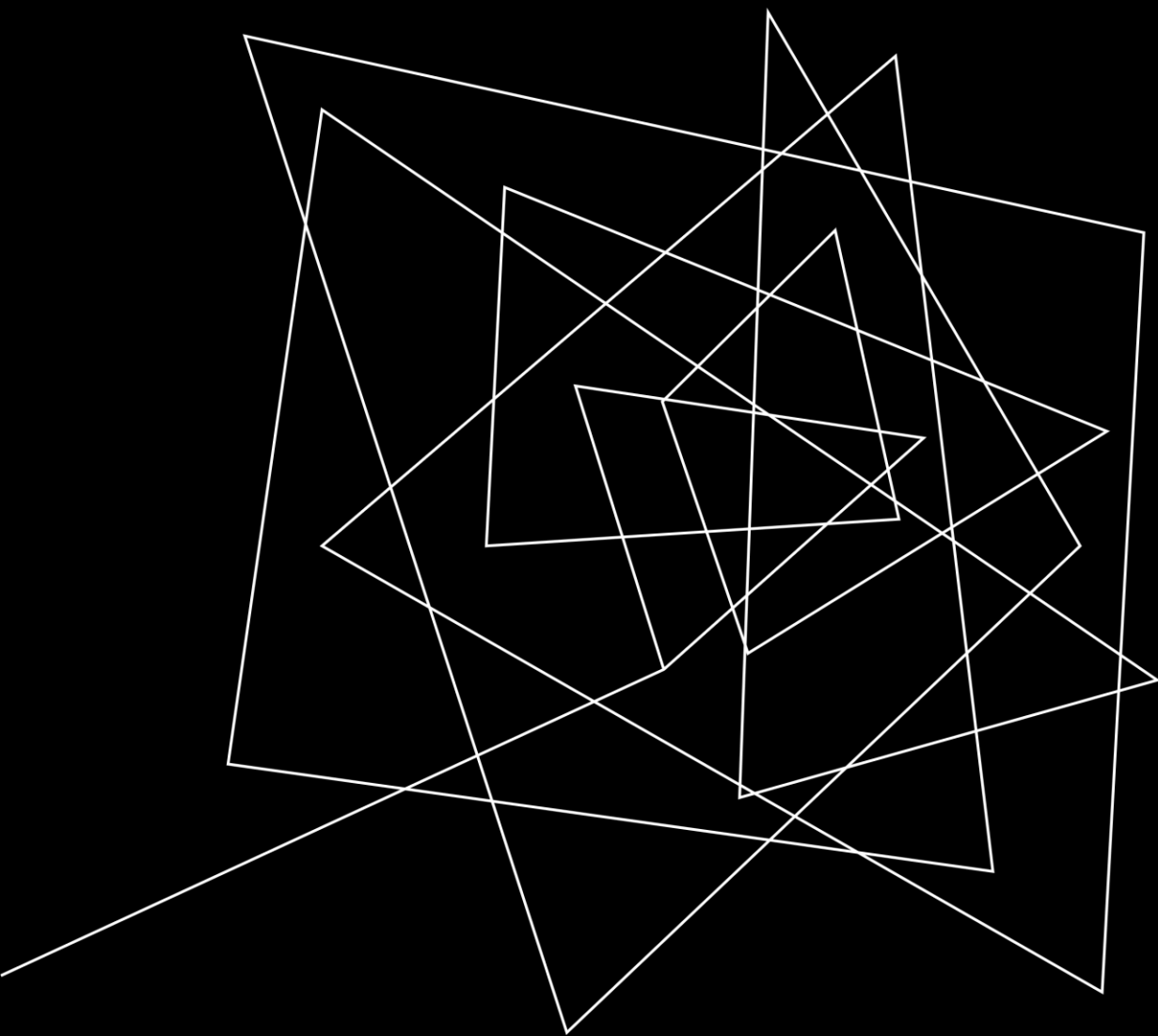


4 As myosin head binds ATP, the cross-bridge detaches from actin



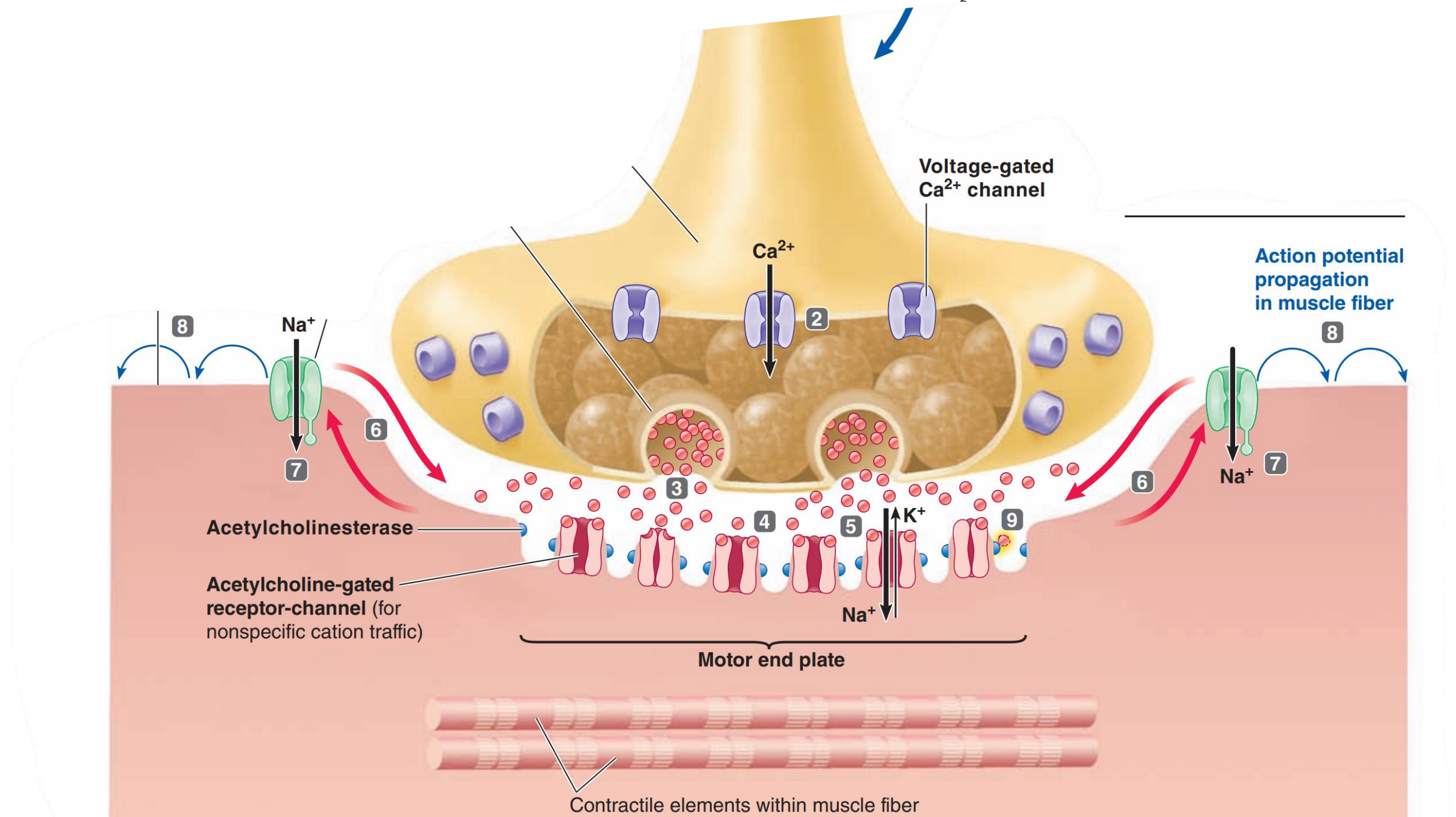
Rigor Mortis (Rigidity of death)

- A condition in which muscles are in a state of rigidity.
- Begins 3–4 hours after death and lasts about 24 hours.
- Explanation : after death, cellular membranes become leaky. Calcium ions leak out of the sarcoplasmic reticulum into the sarcoplasm and allow myosin heads to bind to actin.
- ATP synthesis ceases shortly after breathing stops, however, so the cross-bridges cannot detach from actin.
- It disappears as proteolytic enzymes from lysosomes digest the cross-bridges.

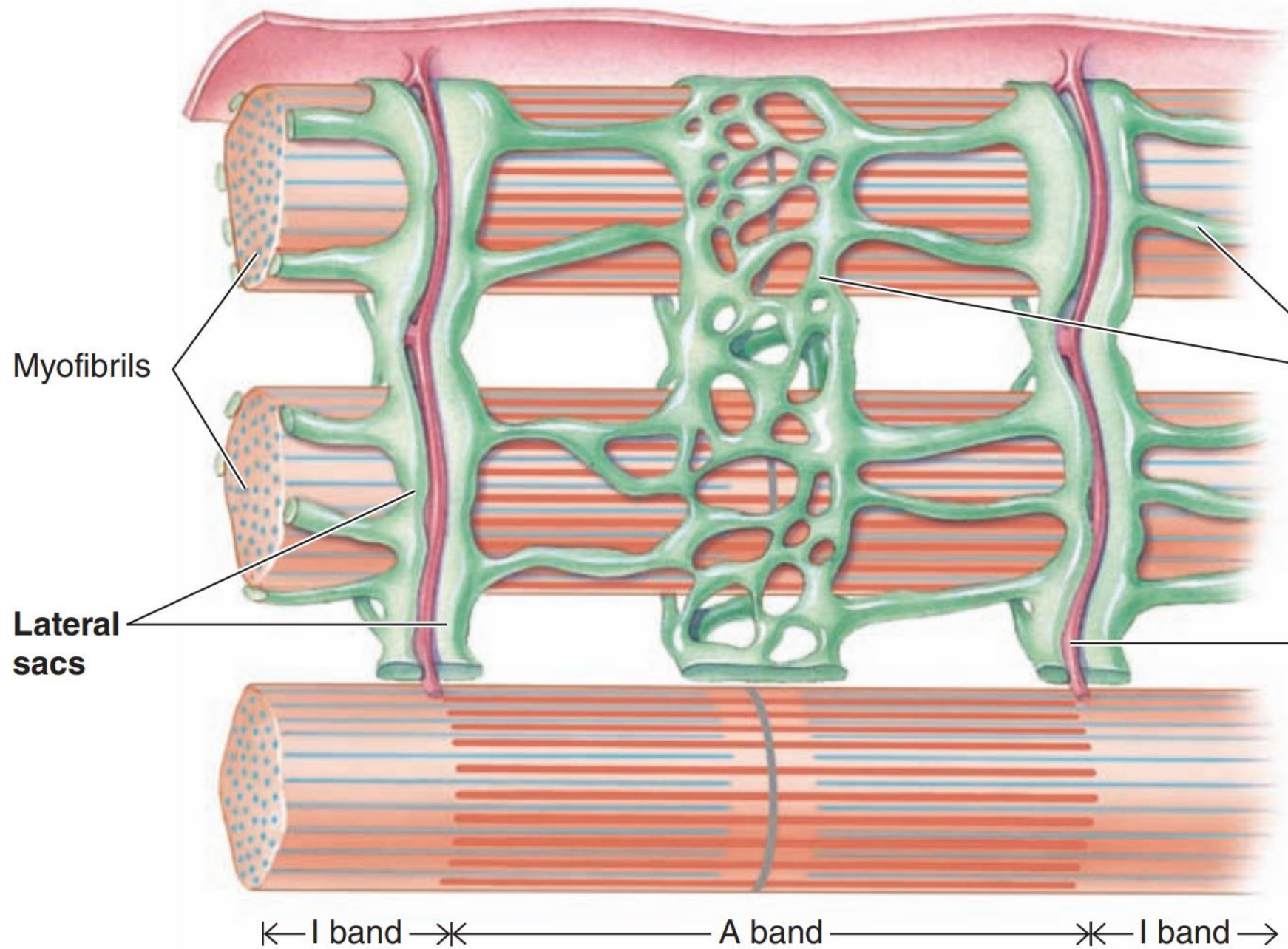


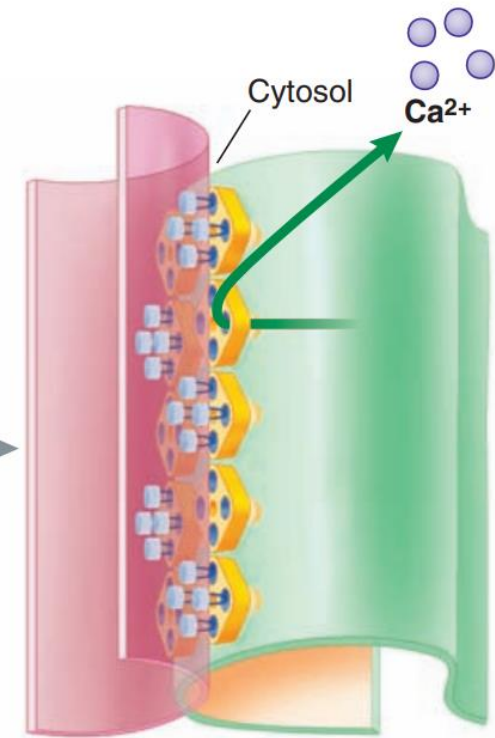
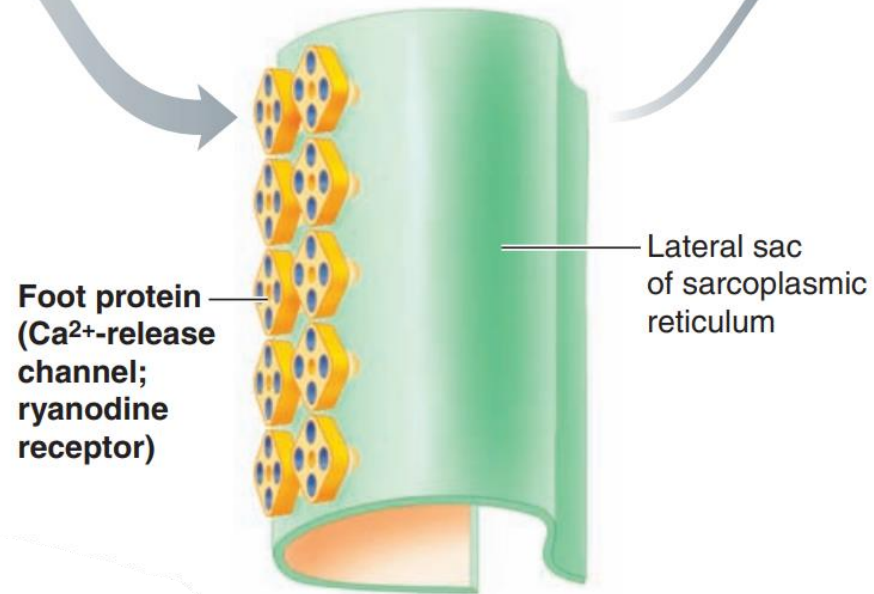
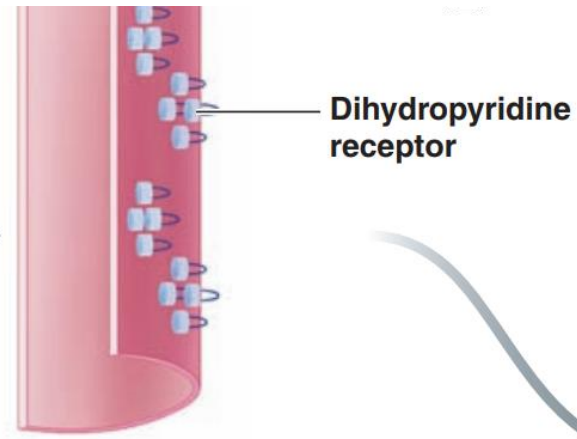
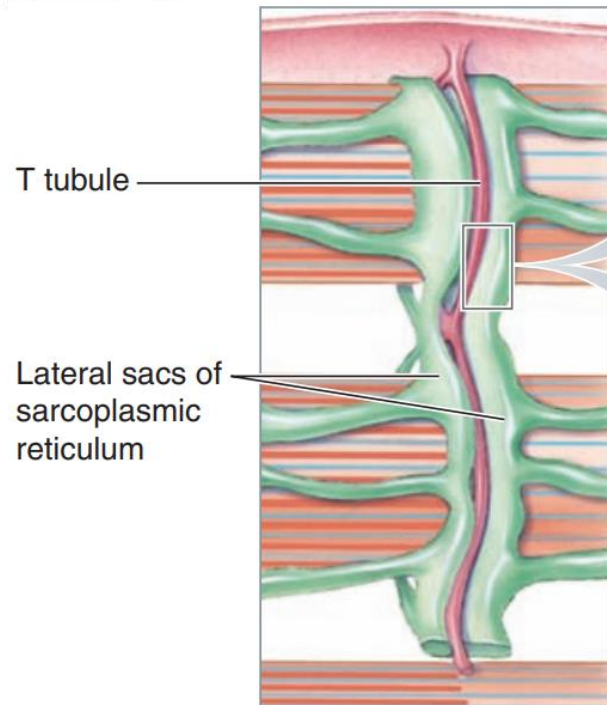
SKELETAL MUSCLE

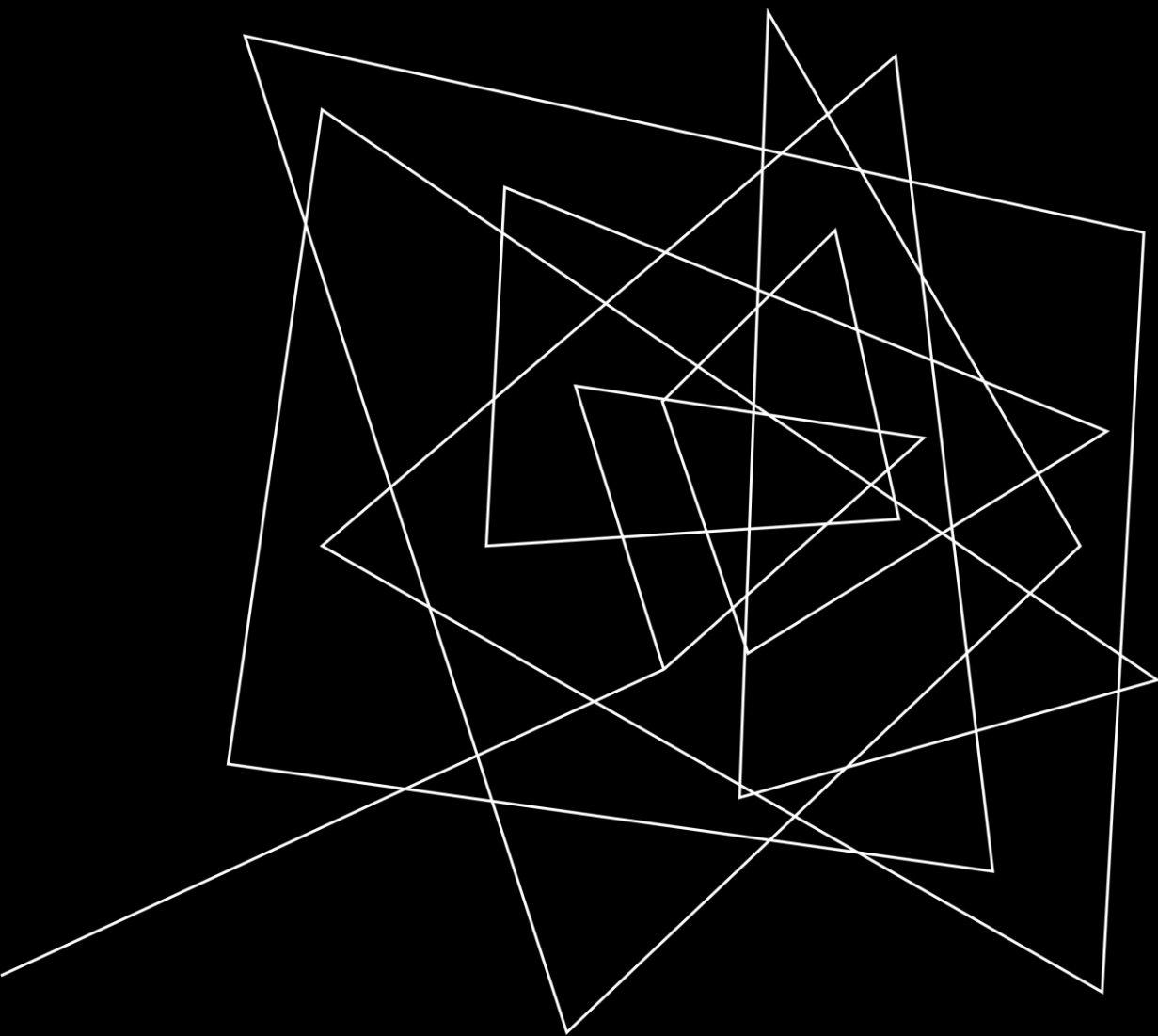
Excitation–contraction coupling



Surface membrane of muscle fiber







SKELETAL MUSCLE

Relaxation

